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ABSTRACT

A study determined if anaerobic power, isometric strength, and isometric endurance are affected by the menstrual cycle and if endurance trained females and untrained females are affected in the same manner on these performance parameters. Subjects were healthy, normally menstruating females, ages 18-34 years who were classified as either trained (n=23) or untrained (n=24). Each subject was tested once during four phases of one complete menstrual cycle. Anaerobic power was determined via the Margaria-Kalamen power test. Isometric strength and endurance of the non-preferred forearm flexor muscle group were determined using a cable tensiometer and strength bench. Study results indicated that there was no significant difference in anaerobic power, muscular strength, or muscular endurance as a result of the menstrual cycle. Additionally, there was no significant difference between the fluctuation patterns of the two groups studied. (Author/JD)

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# MENSTRUAL CYCLE EFFECTS ON ANAEROBIC POWER, MUSCULAR STRENGTH AND MUSCULAR ENDURANCE IN TRAINED AND UNTRAINED FEMALES.

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The purpose of this study was to determine if anaerobic power, muscular strength and muscular endurance are affected by the menstrual cycle and to determine if endurance trained females and untrained females are affected in the same manner on these performance parameters. Subjects were healthy, normally menstruating females, ages 18-34 yrs. Subjects were determined to be trained (N=23) or untrained (N=24) based on their current training status. Subjects were tested once during four phases of one complete menstrual cycle: Premenstrual, Menstrual, Postmenstrual, Intermenstrual. Anaerobic power was determined via the Margaria-Kalamen Power test. Isometric strength and endurance of the non-preferred forearm flexor muscle group were determined using a cable tensiometer and strength bench. The statistical design employed was a 2 (untrained/trained groups) X 4 (phases, which were counterbalanced) repeated measures ANOVA. Results were tested at the .05 level of significance.

The results of this study indicated that there was no significant difference in anaerobic power, muscular strength or muscular endurance as a result of the menstrual cycle. Additionally, the slight variations that do occur are similar for endurance trained and untrained females, as was evidenced by the absence of any significant interaction effects on these performance parameters.

The results of this study are valuable in light of the fact that menstrual cycle effects on those specific performance parameters has not, to date, received adequate attention in research literature. Additionally, trained versus untrained comparisons in the area of menstrual cycle effects on those measurements has been extremely scarce.

Based on the results of this study, it was concluded that neither endurance trained nor untrained females' anaerobic power, muscular strength or muscular endurance appear to fluctuate as a result of menstrual cycle variations. Future research efforts should examine the extent to which other types of athletes are affected by the menstrual cycle on these performance parameters. These other types of athletes might include gymnasts, sprinters, divers, golfers and other "non-aerobically" trained females.

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## ABSTRACT

THE PURPOSE OF THIS STUDY WAS TO DETERMINE IF ANAEROBIC POWER, ISOMETRIC STRENGTH AND ISOMETRIC ENDURANCE ARE AFFECTED BY THE MENSTRUAL CYCLE AND TO DETERMINE IF ENDURANCE TRAINED FEMALES AND UNTRAINED FEMALES ARE AFFECTED IN THE SAME MANNER ON THESE PERFORMANCE PARAMETETERS. SUBJECTS WERE HEALTHY, NORMALLY MENSTRUATING FEMALES, AGES 18-35 YRS. WHO WERE CLASSIFIED AS EITHER TRAINED (N=23) OR UNTRAINED (N=24). EACH SUBJECT WAS TESTED ONCE DURING FOUR FOUR PHASES OF ONE COMPLETE MENSTRUAL CYCLE. ANAEROBIC POWER WAS DETERMINED VIA THE MARGARIA-KALAMEN POWER TEST WHILE ISOMETRIC STRENGTH AND ENDURANCE WAS DETERMINED USING A CABLE TENSIOMETER AND STRENGTH BENCH. THE RESULTS OF THIS STUDY INDICATED THAT THERE WAS NO SIGNIFICANT DIFFERENCE IN ANAEROBIC POWER (POW), ISOMETRIC STRENGTH (STR) OR ISOMETRIC ENDURANCE (END) AS A RESULT OF THE MENSTRUAL CYCLE. ADDITIONALLY, THERE WAS NO SIGNIFICANT DIFFERENCE BTWEEN THE FLUCTUATION PATTERNS OF THE TWO GROUPS STUDIED.

THE RESULTS OF THIS STUDY ARE VALUABLE IN LIGHT OF THE FACT THAT MENSTRUAL CYCLE EFFECTS ON THOSE SPECIFIC PERFORMANCE PARAMETERS HAS NOT, TO DATE, RECEIVED ADEQUATE ATTENTION IN RESEARCH LITERATURE. ADDITIONALLY, TRAINED VERSUS UNTRAINED COMPARISONS IN THE AREA OF MENSTRUAL CYCLE EFFECTS ON THOSE MEASUREMENTS HAS BEEN EXTREMELY SCARCE.



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## INTRODUCTION

THE PURPOSE OF THIS STUDY WAS TO DETERMINE:

(1) IF ANAEROBIC POWER, MUSCULAR STRENGTH AND MUSCULAR ENDURANCE ARE AFFECTED BY THE MENSTRUAL CYCLE AND

(2) IF ENDURANCE TRAINED FEMALES AND UNTRAINED FEMALES ARE AFFECTED IN THE SAME MANNER ON THESE PERFORMANCE PARAMETERS.

MENSTRUAL CYCLE EFFECTS ON MUSCULAR STRENGTH AND ENDURANCE HAS BEEN INVESTIGATED IN SEVERAL PREVIOUS STUDIES. HOWEVER, EVIDENCE OF INVESTIGATION INTO THE EFFECTS OF THIS CYCLE ON ANAEROBIC POWER AND COMPARISONS OF TRAINED AND UNTRAINED FEMALES' RESPONSES DURING THE MENSTRUAL CYCLE IS LACKING. THE FOLLOWING TABLE SUMMARIZES RESEARCH ON MENSTRUAL CYCLE EFFECTS ON MUSCULAR STRENGTH AND ENDURANCE.

### LITERATURE SUMMARY
### MENSTRUAL CYCLE EFFECTS ON MUSCULAR STRENGTH AND ENDURANCE

| INVESTIGATOR(S) | VARIABLE(S) | SAMPLE SIZE | EFFECT* |
|---|---|---|---|
| BILHUBER, 1927 | STRENGTH (GRIP) | 19 | 0 |
| HIGGS & ROBERTSON, 1981 | STRENGTH (GRIP & KNEE EXTENSION) | 12 | 0 |
| MOORE & BARKER, 1923 | STRENGTH (8 MUSCLE GROUPS) | 30 | + |
| PETROFSKY ET AL., 1976 | ISOMETRIC STRENGTH | 7 | 0 |
| | ISOMETRIC ENDURANCE | 7 | + |
| SOUTHHAM & GONZAGA, 1965 | MUSCULAR EFFICIENCY | - | 0 |
| WEARING ET AL., 1972 | STRENGTH (HIP EXTENSION/ FLEXION) | 15 | + |

*EFFECT: + = SIGNIFICANT EFFECT 0 = NO SIGNIFICANT EFFECT

## METHODS

SUBJECTS WERE HEALTHY, NORMALLY MENSTRUATING FEMALES, AGES 18-34 YRS. THEY WERE CLASSIFIED AS TRAINED (N=23) OR UNTRAINED (N=24) BASED ON THEIR TRAINING STATUS AT THE TIME OF THE DATA COLLECTION. EACH SUBJECT WAS TESTED ONCE DURING FOUR PHASES OF ONE COMPLETE MENSTRUAL CYCLE:

PREMENSTRUAL (PRE) - 3 DAYS PRIOR TO MENSTRUAL FLOW
MENSTRUAL (MEN) - 2ND DAY OF FLOW
POSTMENSTRUAL(POST)- 4TH DAY AFTER CESSATION OF FLOW
INTERMENSTRUAL(INTER)-10TH DAY AFTER CESSATION OF FLOW

ALL OF THE FOLLOWING TESTS WERE ADMINISTERED DURING EACH SESSION:

ANAEROBIC POWER (POW) WAS DETERMINED BY THE MARGARIA-KALAMEN POWER TEST, USING AN AUTOMATIC PERFORMANCE TIMER.

ISOMETRIC MUSCULAR STRENGTH (STR) OF THE NON-DOMINANT FOREARM FLEXOR MUSCLE GROUP WAS MEASURED USING A CABLE TENSIOMETER AND STRENGTH BENCH, BY HAVING THE SUBJECT PERFORM A MAXIMUM VOLUNTARY CONTRACTION.

ISOMETRIC MUSCULAR ENDURANCE (END) WAS MEASURED IN THE SAME MUSCLE GROUP BY MEASURING THE AMOUNT OF TIME THAT THE SUBJECT COULD MAINTAIN 80% OF HER MAXIMUM VOLUNTARY CONTRACTION.

## RESULTS

THE STATISTICAL DESIGN EMPLOYED WAS A 2 (TRAINED/UNTRAINED GROUP) x 4 (PHASE, WHICH WERE COUNTER-BALANCED) REPEATED MEASURES ANOVA. RESULTS WERE TESTED AT THE .05 LEVEL OF SIGNIFICANCE.

THE ANOVA'S INDICATED THAT THERE WAS NO SIGNIFICANT PHASE EFFECT FOR POW, STR OR END. ADDITIONALLY, NO SIGNIFICANT INTERACTION EFFECTS WERE DEMONSTRATED. THE FOLLOWING TABLE SUMMARIZES THE RESULTS.

## Means and Standard Deviations

## Anaerobic Power, Muscular Strength, Muscular Endurance

| Group | Phase PRE | MEN | POST | INTER | Row Means |
|---|---|---|---|---|---|
| POW (Kgm/sec) | | | | | |
| Total | 95.35±20.80 | 93.73±17.12 | 92.95±19.15 | 93.54±19.19 | - |
| Trained | 96.94±19.59 | 94.59±16.17 | 96.97±19.69 | 96.32±18.75 | 96.20±18.07 |
| Untrained | 93.83±22.20 | 92.83±18.41 | 88.92±19.16 | 90.88±19.63 | 91.62±19.71 |
| | F ratios: Group, 0.94; Phase, 1.70; Group X Phase, 1.99 | | | | |
| STR (Kg) | | | | | |
| Total | 25.72± 4.67 | 25.08± 5.22 | 25.27± 4.72 | 25.67± 5.56 | |
| Trained | 25.96± 4.18 | 25.43± 4.79 | 24.74+ 3.45 | 25.92± 4.42 | 25.51± 4.20 |
| Untrained | 25.50± 5.18 | 24.74± 5.70 | 25.79± 5.72 | 25.43± 6.56 | 25.37± 5.73 |
| | F ratios: Group, 0.02; Phase, 0.88; Group X Phase, 1.35 | | | | |
| END (sec) | | | | | |
| Total | 34.75±17.22 | 31.83±10.47 | 37.38±21.84 | 32.56±13.67 | - |
| Trained | 39.25±21.81 | 32.20±10.50 | 42.63±26.32 | 31.57±15.37 | 36.42±19.71 |
| Untrained | 30.44± 9.90 | 31.47±10.66 | 32.34±15.40 | 33.50±12.07 | 31.94±12.06 |
| | F ratios: Group, 1.99; Phase, 1.59; Group X Phase, 2.18 | | | | |

$p \leq .05$

## DISCUSSION

THE RESULTS OF THIS STUDY ARE IN AGREEMENT WITH MANY PREVIOUS FINDINGS CONCERNING THE LACK OF STRENGTH OR ENDURANCE FLUCTUATIONS CONCOMITANT WITH THE MENSTRUAL CYCLE. THIS STUDY ADDS ANAEROBIC POWER TO THE LIST OF PHYSIOLOGIC PARAMETERS THAT ARE MOST PROBABLY NOT SUBJECT TO FLUCTUATIONS DUE TO THE AFFECTS OF THE MENSTRUAL CYCLE. ANOTHER UNIQUE FINDING FROM THIS STUDY IS THE FACT THAT TRAINING STATUS (AS DEFINED BY THE AUTHORS) DOES NOT APPEAR TO SIGNIFICANTLY AFFECT THE FLUCTUATION PATTERNS OF THOSE VARIABLES STUDIED DURING THE MENSTRUAL CYCLE.

## CONCLUSIONS

BASED ON THE RESULTS OF THIS STUDY, THE FOLLOWING CONCLUSIONS WERE REACHED:

(1) FLUCTUATIONS IN ANAEROBIC POWER, ISOMETRIC STRENGTH AND ISOMETRIC ENDURANCE DURING THE MENSTRUALCYCLE ARE NOT SIGNIFICANT,

(2) FLUCTUATION PATTERNS ARE SIMILAR IN AEROBICALLY TRAINED AND UNTRAINED FEMALES, AND

(3) FUTURE RESEARCH EFFORTS SHOULD EXAMINE THE EXTENT TO WHICH OTHER TYPES OF ATHLETES (I.E. GYMNASTS, SPRINTERS AND OTHER "NON-AEROBICALLY" TRAINED FEMALES) ARE AFFECTED BY THE MENSTRUAL CYCLE ON THESE PERFORMANCE PARAMETERS.

## References


Bilhuber, G. Functional periodicity and motor ability in sports. American Physical Education Review, 1927, 32, 22-25.

Niggs, S.L. and Robertson, L.A. Cyclic variations in perceived exertion and physical work capacity in females. Canadian Journal of Applied Sport Sciences, 1981, 6(4), 191-196.

Moore, L.M. and Barker, J.L. Monthly variations in muscular efficiency in women. American Journal of Physiology, 1923, 64(3), 405-415.

Petrofsky, J.S., LeDonne, D.M., Rinehart, J.S. and Lind, A.R. Isometric strength and endurance during the menstrual cycle. European Journal of Applied Physiology, 1976, 35(1), 1-10.

Southam, A.L. and Gonzaga, F.P. Systemic changes during the menstrual cycle. American Journal of Obstetrics and Gynecology, 1965, 91(1), 142-165.

Wearing, M.P., Yuhosz, M.D., Campbell, R. and Love, E.J. The effects of the menstrual cycle on test of physical fitness. Journal of Sports Medicine and Physical Fitness, 1972, 12(1), 38-41.